Fournier's gangrene: non-clostridial gas gangrene of the perineum and diabetes mellitus

A J Lamerton FRCS MRCP *St Mary's Hospital Medical School, London W2*

Summary
Three successfully managed cases of Fournier's gangrene, all with diabetes, are reported. A simple bacteriological classification is offered and the importance of diabetes mellitus as a predisposing factor is stressed.

Introduction

In 1883 Fournier[1], a French venereologist, reported five healthy young men with the abrupt onset of a rapidly progressive form of gangrene of the scrotum and penis for which no obvious cause could be found. Since then the syndrome has come to include all necrotizing subcutaneous infections of the male and female perineum[2]. Three cases of the syndrome are reported, all with diabetes.

Case reports

Case 1: A 51-year-old woman, a maturity-onset diabetic on oral treatment for five years, was admitted in November 1977. Sixteen months previously an abscess in the labium major in the region of the right groin crease had burst, leaving her with a discharging sinus. Eight days prior to admission a second abscess nearby had discharged in spite of a course of ampicillin and tetracycline by mouth, and another sinus had formed. On admission she had septicaemia and a large area of spreading crepitant necrosis from pubis to knee anteriorly on the right thigh. A random blood glucose was 11.8 mmol/l (3.0–5.0 fasting) and X-rays confirmed gas in the tissue planes. Wide debridement of the sinuses and skin, subcutaneous tissue and muscle of the anterior compartment was performed. Culture grew *Proteus mirabilis, E. coli, Bacteroides fragilis* and two types of anaerobic peptostreptococcus. Gentamicin 80 mg 8-hourly, metronidazole 500 mg 6-hourly and benzylpenicillin one megaunit 6-hourly were given intravenously for five days.

A further pocket of infection in the thigh was drained eight weeks later (Figure 1) and a split-skin graft was applied a week after this. The patient was discharged after ten weeks in hospital. Six weeks later the wound had healed completely, and the patient remained well until her death from a myocardial infarction six years later in January 1984.

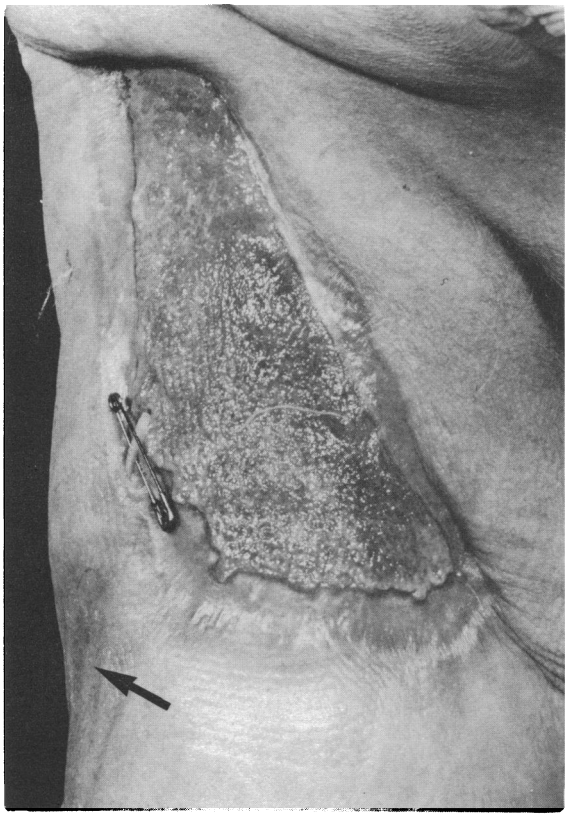

Figure 1. Case 1. The wound of the right thigh prior to grafting is almost healed by secondary intention at 8 weeks. Drain under bridge to a further pocket of infection (arrowed)

Case 2: A 63-year-old Indian man, an insulin-dependent diabetic of 23 years, was admitted in December 1983. A left-sided perianal abscess diagnosed four days previously had failed to settle on oral flucloxacillin and for 48 hours he had become increasingly drowsy with polydipsia and polyuria. He was an unwell, obese man in diabetic precoma, with a brawny erythematous swelling around the left side of the anal verge extending anteriorly over the scrotum to the groin.

A random blood glucose was 26.6 mmol/l and there was heavy glycosuria. Local incision and drainage of a perianal abscess was performed, little pus being evacuated. Cultures revealed faecal streptococci with Gram-negative rods, and the antibiotic was changed to metronidazole 500 mg 6-hourly and gentamicin 80 mg 8-hourly intravenously.

There was improvement, but 48 hours later he developed florid septicaemia with spreading perineal necrosis. Examination under anaesthesia was performed and wide debridement carried out (Figure 2). On the strength of bacterial sensitivities, ampicillin 1 g 6-hourly was added to the antibiotic regimen, which was continued for a further seven days. His recovery was uninterrupted and he was discharged on the 23rd day. Eight weeks later the wound had almost healed by secondary intention (Figure 3). He remains well 12 months later.

0141-0768/86/
040212-04/$02.00/0

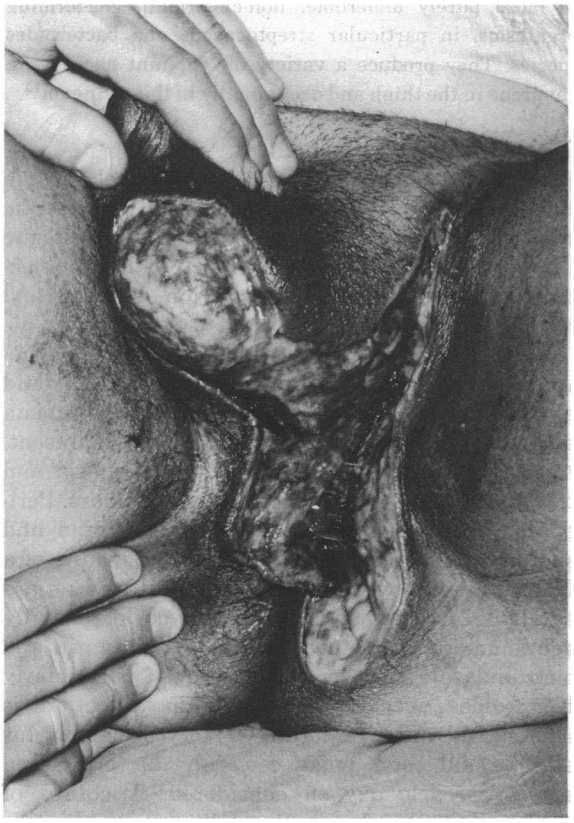

Figure 2. Case 2. The perineal wound 14 days after surgery

Case 3: A 54-year-old hypertensive man, a maturity-onset diabetic on oral therapy for 8 years, was admitted in October 1982. Ten days previously he had developed pain in the right loin which had migrated to the groin and thigh six days later. Forty-eight hours prior to admission the right side of the scrotum, perineum and buttocks had developed painful swelling with discoloration. He was an obese man with septicaemia, diabetic precoma and cutaneous inflammatory changes involving the right loin, groin and inner aspect of the thigh to the calf. There was necrosis of the scrotum. A random blood glucose was 21.9 mmol/l. Debridement of the right scrotum and groin was performed and cultures grew Gram-negative and positive rods, anaerobic Gram-positive cocci and β-haemolytic streptococcus. Gentamicin 120 mg 8-hourly, benzylpenicillin 2 megaunits 4-hourly, and metronidazole 500 mg 8-hourly were given intravenously. He remained unwell and 48 hours later further toilet of the right inguinoscrotal wound was performed and the tissues of the abdominal wall and extraperitoneal space of the right iliac fossa also debrided.

Figure 3. Case 2. The perineal wound virtually healed at 3 months

The diabetes remained difficult to control and three days later further extensive debridement was undertaken to include the perineum and saddle area. Two further abscesses in the right leg were drained 12 days later. His recovery over the next $11\frac{1}{2}$ months was very slow and included attacks of right basal pneumonia, arrhythmias and left ventricular failure, blood transfusion on five occasions, many courses of antibiotics, long periods of enteral and parenteral nutrition, anticoagulation and antibiotic wound irrigation. There were three further visits to theatre, including one for debridement of a pressure area on the left hip on which he had been lying for many months. He was discharged after nearly one year of inpatient stay and healing had occurred at the three-month clinic visit. He has remained well for 12 months of follow up.

Discussion

Aetiology

In his original description Fournier implicated sepsis and suggested that diabetes mellitus was a predisposing factor[1]. There are a number of theories to explain the predilection of idiopathic cases for the perineum in general and the scrotum in particular: perspiration and poor personal hygiene[3] encourage a large bacterial population in the loosely folded skin of the scrotum, which may trap organisms that are then driven into the lax areolar subcutaneous tissue by the minor trauma occurring continually in this area. Furthermore, the very laxity of this layer may encourage the formation of oedema at an early stage in the inflammatory process[4], which may further prejudice the blood supply and result in cutaneous gangrene. Certainly, widespread thrombosis of subcutaneous vessels is a prominent feature of Fournier's gangrene.

Recently many predisposing factors have been described[5-7]. Most cases now fall into those secondary to a large variety of local urinary tract or colo-ano-rectal disorders. A significant number of patients have an underlying chronic debilitating general systemic disease, like diabetes mellitus, rendering them susceptible to infection.

Clinical presentation

Perineal gangrene now occurs in a generally older population[8] than that originally described by Fournier. However, there is still a wide range from childhood to old age. The male-to-female ratio is greater than two to one. The patient may have been unwell for several days before coming to hospital

and severe scrotal pain is the presenting symptom. The incubation period, as measured from the onset of pain to the development of scrotal signs, varies from a few hours to seven days[9].

On examination, there is considerable swelling and tenderness which progresses to cutaneous gangrene. Some authors have drawn attention to the early appearance of the diagnostic 'Black Spot'[9]. Crepitus and a putrid odour is invariable. The process may extend posteriorly to involve the saddle area, or anteriorly to the penis, groin, the lower abdominal wall or the thighs. Septicaemia may ensue and progression to multisystem failure carries a poor prognosis. Multiple surgical procedures are often required and inpatient stay is protracted and is variously documented at between 20 and 180 days for survivors. Mortality ranges from 7% to 50%[7].

Pathology

The bacteriological classification of the forms of cutaneous gangrene has been complicated[9] for a number of reasons. Surface skin swabs alone are unreliable and unless the necrotic tissue removed at operation is sent directly for bacteriological examination, inaccuracies regarding the variety of organisms and their types will arise[10]. It is mandatory to perform a Gram stain on fresh surgical tissue, as many of these organisms require special culture techniques and will not be isolated unless the bacteriologist is alerted to their presence[5]. Many laboratories in the past have had insufficient facilities adequately to culture anaerobes[7,9].

It is suggested here that there are three bacteriological groups, whose clinical pictures largely overlap, which are included under the description of Fournier's gangrene when they involve the perineum:

(1) The anaerobic Gram-negative rod *Clostridium perfringens* and others not only cause gas gangrene after contaminated trauma of the limbs, but also involve the perineum, particularly when there is colorectal pathology[7]. Local pain and general toxicity is marked and there is considerable oedematous cellulitis, and often myositis, with much gas formation. The additional presence of a large variety of non-clostridial organisms in culture is not uncommon and is now regarded as superinfection, and of secondary importance, rather than playing a truly synergistic role.

(2) It is well established that non-clostridial organisms commonly cause infection in ischaemic diabetic limbs. They also form the largest group in the recent literature causing perineal gangrene. Necrotizing (superficial) fasciitis is due to synergistic infection by any combination of one or several non-clostridial aerobic and anaerobic organisms. The common aerobes are the Gram-positive staphylococci and streptococci and the enteric Gram-negative rods. The most frequent anaerobes are the Gram-positive streptococci and Gram-negative bacteroides. It is not unusual for as few as two or as many as seven organisms to be cultured. Meleney's progressive bacterial synergistic gangrene[11] is caused specifically by two organisms, the aerobic *Staph. aureus* and an anaerobic streptococcus. Typically it occurs postoperatively on the anterior abdominal wall, but may involve the perineum after surgery in that region. Meleney's infection is confined to the skin and subcutaneous layers and, though indolent, causes little in the way of general toxicity.

(3) Anaerobic cellulitis/myositis may be caused by one or more purely anaerobic, non-clostridial, gas-forming organisms, in particular streptococcus and bacteroides species. They produce a variety of crepitant necrotizing gangrene in the thigh and occasionally in the perineum[12].

Treatment

As a general rule the patients are unwell by the time they come to surgery by virtue of their septic state complicated by whatever underlying systemic illness they may have. There are three objectives of management: resuscitation, surgery and rehabilitation.

Resuscitation takes the usual form of cardiovascular support, rehydration, correction of fluid and electrolyte balance, treatment of septicaemia and attention to diabetic ketoacidosis when present. As there has often been delay in diagnosis and treatment, resuscitation may take some hours. Perioperative antibiotics must be prescribed 'blind' and should cover all eventualities until the results of a Gram stain followed by culture and sensitivities are available. An intravenous aminoglycoside, usually gentamicin, is combined with a cephalosporin and metronidazole to cover the anaerobes, particularly bacteroides species. If clostridium infection is implicated, then penicillin G (erythromycin for allergic subjects) must certainly be prescribed and hyperbaric oxygen considered. A course of antibiotics for ten days will usually suffice.

Surgery should be undertaken at the earliest possible opportunity and should include wide debridement of all necrotic tissue[8]. As a rule the infection is superficial and wide perineal excision may be performed without fear of serious damage to deep structures. Because of their blood supply, the testes and anal verge are spared the necrotic process. If there is a genitourinary or colorectal cause, then appropriate temporary diversion may be advisable to accelerate recovery[7]. A large variety of equally satisfactory topical methods may be used to encourage healing postoperatively by secondary intention[5]. Only occasionally is skin grafting or plastic surgery required. However, several visits to theatre to change dressings and/or perform further toilet and debridement may be needed. In-hospital stay is protracted and rehabilitation may be slow in the extreme, requiring the services of the medical, anaesthetic and nursing staff, the pathology laboratory, diabetic physician, pharmacist, nutritionist as well as the physiotherapy and occupational therapy departments.

Fournier's original description has become modified over the years to include a more insidious onset with a gradual and less toxic course in an older age group of both sexes with wider clinical presentation and a number of predisposing factors identifiable in most cases[2].

As the syndrome is unusual (less than 1% of all urological admissions), the experience of each individual centre is small and consequently cases of clostridial and non-clostridial gangrene are often grouped together[7,9] and with septic gangrene in other territories such as the limbs[13]. Furthermore, incomplete bacteriological evaluation may make it impossible accurately to assign cases to particular groups. Thus, neither can the causative organism be deduced from the clinical picture nor can a correlation be made between organisms and severity and course of illness, or morbidity and mortality.

The immunoparesis of the chronic diabetic is well documented, and non-clostridial infection was first implicated in the septic ischaemic diabetic foot[14]. It is not surprising, therefore, that diabetes mellitus is being reported with increasing frequency as a predisposing factor in non-clostridial gas gangrene of the perineum[7,13]. Maturity-onset diabetics are particularly at risk from the secondary causes, as they are in an age group where incipient urinary obstruction due to benign prostatic hyperplasia is common and are additionally prone to adult phimosis[6], autonomic neuropathy, urinary infection, obesity, intertrigo and recurrent perianal sepsis[7]. Delay in diagnosis and treatment may be particularly prolonged if there is an element of diabetic perineal sensory neuropathy. Consequently, many patients arrive at hospital in an advanced septic state with diabetic precoma. Conversely, Fournier's gangrene may precipitate diabetes with ketoacidosis for the first time[10]. Streptococcal gangrene of the thigh has been described in the diabetic following insulin injections[12] but most infections of the diabetic perineum are of the non-clostridal type. In some series the mortality is two to three times higher (73%) in the diabetic population[15,16].

The clinical condition requires that antibiotics are started before cultures are available, but early bacteriological analysis is mandatory for correct antibiotic treatment. The very high mortality reported in some series may reflect incomplete bacterial analysis and thus insufficient antibiotic cover.

This high mortality may be further explained by the fact that apparently minor septic conditions of the perineum are often treated initially in theatre by more junior staff who may not recognize the true situation and who may, understandably, be unwilling to undertake extensive debridement of an area such as the perineum[2]. Even when early surgical toilet is thorough, the very nature of the slowly progressive necrotizing process may dictate that treatment is only adequate after several further visits to theatre for debridement, diversion or plastic surgery over a period of many weeks or months.

The message from the literature, exemplified by our cases, is clear: acceptable survival can only be achieved by a high index of suspicion leading to prompt diagnosis, proper resuscitation and early adequate debridement by an experienced surgeon, followed by the use of the correct antibiotics guided by accurate bacteriology, a willingness to return to theatre and aggressive, long-term rehabilitation.

Acknowledgments: I am grateful to Mr J Horner FRCS, Consultant Surgeon, under whose care Case 3 was successfully managed, and the staff of Ashford Hospital, Middlesex. Thanks are also due to Dr Cardew and the Photographic Department of St Mary's Hospital for the photographs.

References

1 Fournier AJ. Gangrene foudroyante de la verge. *Semaine Medicale (Paris)* 1883;**3**:345–8
2 Bahlmann JC, Fourie IJ, Arndt TC. Fournier's gangrene: necrotizing fasciitis of the male genitalia. *Br J Urol* 1983;**55**:85–8
3 Biswas M, Godec C, Ireland G, Cass A. Necrotizing infection of scrotum. *Urology* 1979;**14**:576–80
4 Haury B, Rodenheaver G, Stevenson T, Bacchetta C, Edgerton MT, Edlich RF. Streptococcal cellulitis of the scrotum and penis with secondary gangrene. *Surg Gynecol Obstet* 1975;**141**:35–9
5 Deittrich NA, Mason JH. Fournier's gangrene; A general surgery problem. *World J Surg* 1983;**7**:288–94
6 Walker L, Cassidy MT, Hutchinson AG, Abel BJ, Lewi HJE. Fournier's gangrene and urethral problems. *Br J Urol* 1984;**56**:509–11
7 Spirnak JP, Resnick MI, Hampel N, Persky L. Fournier's gangrene: Report of 20 patients. *J Urol* 1984;**131**:289–91
8 Jones RB, Hirshamm JV, Brown CS, Tremann JA. Fournier's syndrome: Necrotizing subcutaneous infection of the male genitalia. *J Urol* 1979;**122**:279–82
9 Bubrick MP, Hitchcock CR. Necrotizing anorectal and perineal infection. *Surgery* 1979;**86**:655–61
10 Slater DN, Smith GT, Mundy K. Diabetes mellitus with ketoacidosis presenting as Fournier's gangrene. *J R Soc Med* 1982;**75**:530–2
11 Meleney FL. Bacterial synergism in disease processes. *Ann Surg* 1931;**94**:961–80
12 Anderson CB, Marr J, Jaffe BM. Anaerobic streptococcal infections simulating gas gangrene. *Arch Surg* 1972;**104**:186–9
13 Darke SG, King AM, Slack WK. Gas gangrene and related infection. Classification, clinical features and aetiology, management and mortality. A report of 88 cases. *Br J Surg* 1977;**64**:104–12
14 Bessman AN, Wagner W. Non-clostridial gas gangrene: Report of 48 cases and review of the literature. *JAMA* 1975;**233**:958–63
15 Fisher JR, Conway MJ, Kakeshita RT, Sandoval MR. Necrotizing fasciitis. *JAMA* 1979;**241**:803–6
16 Oh C, Lee C, Jacobson JH. Necrotizing fasciitis of perineum. *Surgery* 1982;**91**:49–51

(Accepted 18 November 1985. Reprint requests to AJL at the Manor House, Church Lane, Cherry Willingham, Lincoln LN3 4AB)